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JUNE 6.

The President, Dr. RUSCHENBERGER, in the chair.

Forty-five members present.

Fertilization of Flowers by Insect Agency.—Mr. THOMAS MEEHAN remarked that the subject of cross fertilization and fertilizing by insect agency, was still one of absorbing interest.

There was no question about the facts; differences of opinion arose as to the meaning of the facts, and the extent to which they prevailed.

Contrary to the belief of many distinguished botanists, he could not see that those plants which were arranged for cross fertilization had any advantage in the "struggle for life" which prevailed in races, over those which were closely fertilized by their own pollen; and again, he found that many plants which were adduced by his friends to prove arrangements for cross fertilization, in fact fertilized themselves.

He said he would to-night refer only to three remarkable cases, the Scrophularia, dandelion and ox-eye daisy, and the red clover, and he selected these, because the distinguished author of "How Plants Behave," Professor Asa Gray, had made much use of the two first named in his book in describing arrangements for cross fertilization; and, as Professor Gray was present this evening, he felt sure that with his usual friendliness and good feeling towards all who were earnestly seeking the truth, he would do the meeting the favor to correct him if he found the speaker's observations not confirmed by his own. Red clover he would refer to, because it was oftener quoted. Red clover was, in fact, the *Vade mecum* of the insect fertilizationist.

Mr. Meehan then exhibited specimens of *Scrophularia canina*, and explained its floral development. The pistil protruded while yet the anthers were rolled back in the throat of the corolla. One by one these stamens were straightened out, the anther coming into close proximity with the stigma, when it burst, and by the contraction of the sacs, the pollen was ejected, falling on the stigma. The pollen was of a brilliant orange color, and the stigma of a pearly white, so that the smallest particle could be seen even by a good naked eye; and could be easily noted if carried to the stigma of other flowers by insects. Small sand wasps and other winged insects visited the flowers in extraordinary abundance; but it could be seen by observers that no pollen appeared on any stigma until the bursting of its own pollen sacs. Professor Gray, he said, in "How Plants Behave," had described "Scrophularia" as acting in a very different way to this, making no exceptions to any species, though it was fair to note that the illustration accompanying the text was of *Scrophularia nodosa*, a species not yet in flower with him.

Composite plants, he said, had been referred to as illustrating the peculiar arrangements for insect fertilization. The colored ray petals had been characterized by his friend as so many flags alluring winged insects to where the sweet secretions were, in order that they might bring foreign pollen at the same time. In his vicinity, surrounded as he was by an abundance of sweet flowers, he had never seen a winged insect on dandelion or ox-eye daisy (*Chrysanthemum leucanthemum*), though, on the waste grounds near him, they were in bloom by the thousand; but every little flower perfected a seed. There were millions on millions of seeds, and even admitting that there might be some winged insects at them that he did not see, they were certainly so scarce that it was out of the question to suppose that each of these had been fertilized by winged insects. He had found thrips in some flowers and on one occasion an ant, but these were too few for the immense work to be done. But this presumptive argument was unnecessary, as a careful observation of how the plants behaved, showed they were self-fertilizers. In the dandelion, he said the united column of stamens perfected, and spread its pollen in advance of the pistil. As the pistil grew it carried the pollen with it. The apex of the pistil then forked, and as the interior surface of the cleft alone had the stigmatic surface, it had been argued that none of the pollen could be used for itself. But a watcher would see that as the cleft opened the pollen on the *line of the cleft* fell in. It was but a little, but that was enough. Then the position of the upper part of the pistil in the dandelion favored this intrusion of the pollen. Just before the expansion of the stigmatic lobes, the pistil curved at the apex, and the slit opened first on the upper side of this then horizontal position. The pollen easily fell into the chasm. The lobes finally separated, until they became directly opposite to each other as generally seen in the dandelion. While this is going on, the lobes, having pollen abundantly on the under side, as they are sweeping the horizon, drop pollen, or even rub their surfaces on the expanded stigmas of the flowers below, and in this way, if they had no pollen of their own, the lower flower would be fertilized by that above. This would be cross-fertilization, but not by insect agency. But what if it were? Physiologically speaking, what benefit can it be to a composite flower to be fertilized by another from its own head, even granting the utmost asked by those who consider composites arranged for cross-fertilization? The composite flower is not a compound flower, it is true. It is but an imperfect umbel. But each umbel for all physiological purposes might as well be a single flower. Side by side the flowers are set, as any one familiar with the dotted thimble-like receptacle of dandelion very well knew. They all had just the same food, the same light, the same conditions of life in every material effect. If the familiar illustration by reference to the human family has any weight in plants, surely these flowers must be brother and sister, in any sense claimed by insect fertilizationists; and the physiological benefits to the race would be no more than if the whole head was a single flower, as a Ranunculus, instead of the compound flower we see. He then explained the manner of fertilization in the ox-eye daisy. The united column of stamens was forced from its holdings by the growing pistil, which finally attempted the cleavage of the apex, while still holding the cap-like covering of anthers over it. The pollen fell into the stigmatic cavity more easily than in the dandelion. Insects might visit it subsequently; it would make no difference, having already received its own pollen.

In regard to clover, Mr. Meehan said that in his remarks at Detroit last year, he had stated that he had watched a field of clover, found remarkably few insects at work, and yet the crop of seed was abundant, and that a careful examination of the clover blossom in all its stages convinced him that from its structure and behavior it was a self-fertilizer. He had been met with the assertion that the first crop of clover never produces any seeds. This was so generally believed that it must be true to a great extent. He could not have been mistaken last year, but he visited a field of two acres again a few days ago, and now exhibited heads nearly mature, all the flowers with seeds, and these (June 6th) about the first flowers that could have formed. On this visit he watched the field for an hour, and in that time saw only eight humblebees at work, rather small grist, he thought, for so large a mill, if all those flowers had to be insect fertilized. He watched their motions closely, and found, to his astonishment, that in spite of the elaborate arrangements for the work of the humblebees in the mouth of the corolla, they did not enter that way at all! They made a *slit in the base of the tube*, extracting the honey in this surreptitious way. With this final fact, if found general, there must be an end of the clover case. There was no bottom for the "arrangements" to stand on.

He had intended, he said, to rest the case here, but he had mentioned to his friend, Professor Gray, that he had noted the common bladder-nut, *Staphylea trifolia*, as being a self-fertilizer. It was one of those observations so recently made by him that he should not have introduced it to this body without further investigation; but Dr. Gray had suggested to him to refer to it, as he thought he could show it could not be fertilized except by insects, so he detailed what he had seen simply in order to have the benefit of Dr. Gray's experience.

Dr. Asa Gray said that Mr. Meehan and himself, looking at the same subjects with somewhat opposing prepossessions, were apt to see different facts; that is, either was likely to notice some particular which was not noticed by the other. For instance, Mr.

Meehan had some little time ago called his attention to the bladder-nut (*Staphylea*) as a case of close fertilization; but Dr. Gray's own observations, made in consequence of this suggestion, convinced him that this was a good case of arrangement for cross-fertilization. Like many other flowers, it was capable of self-fertilizing; for the anthers, charged with pollen, were contiguous to the edges of the dilated stigmas. But what his acute friend had omitted to notice was—that the flowers were hanging, and that, although the anthers surround the stigmas, the pollen is not ejected, but lies on the opened face of the anther in a thick coating, and when it falls, it will drop to the ground instead of upon the receiving stigmatic surface; some, however, may come in contact with its margin. Moreover, Dr. Gray found that the stigma was earlier than the anthers by twenty-four or forty-eight hours. The stigmas, borne on styles then considerably longer than the stamens, occupied the very entrance of the corolla as soon as it began to open, and was, as he found, in condition to be pollenated a day or two before the anthers of that blossom opened. Now in each raceme there were flowers in all stages, and the blossoms, as Mr. Meehan declared, were the favorite resort of bees; these while feeding from a flower with anthers open must needs smear their faces with the pollen, and when visiting flowers a day or two younger deposit some of this pollen upon their stigma, at a time when it could not possibly get any from its own anthers.

As to *Scrophularia*, his observations upon *S. nodosa* had prepared him to make a different reading of the facts now shown in *S. canina*. The arrangements for cross-fertilization in *S. nodosa*, as detailed and figured in the little treatise which Mr. Meehan referred to, seemed essentially similar in *S. canina*, except that both stamens and style were much exserted. Mr. Meehan had described the early protrusion of the style and the straightening and lengthening of the filaments a day or two later, so as then to bring the anthers into proximity with the stigma. But Dr. Gray doubted if any of that pollen ever acted upon the contiguous stigma, even if it reached it, thinking it more probable that the stigma was by this time withered and past fertilizing, as was the case in its relative, *S. nodosa*. The arrangement was a capital one for cross-fertilization, bees passing from flower to flower, brushing the same part of their body against the anthers of an older and the stigma of a younger flower; while self-fertilization was impracticable, at least, in *S. nodosa*, because no one flower shed its pollen until its stigma was past receiving it.

As to clover, Dr. Gray could now say nothing, except that it was a member of a tribe of plants which, though seemingly arranged for self-fertilization, were actually for the most part capital examples of the contrary.

His attention had been called by Mr. Meehan to Dandelions, which, from general recollection, he thought were frequented by flying insects. The first walk he took in his own neighborhood did not confirm this impression; but on the second he found small wasps and a dipterous insect busy with the dandelions, and flying from one to another, and also ants in abundance. It was clear that the narrowness of the style-branches in this and other liguliflorous compositæ gave them a chance for self-fertilization, but their characters were equally good for crossing through insect agency. As to ox-eye daisy, he could not confirm Mr. Meehan's description as to the carrying up of the anthers upon the style, which must have been abnormal. Dr. Gray supposed that the arrangement would be found to be like that of the allied Feverfew, which was well figured by Lubbock, after Ogle, and this clearly betokened cross-fertilization. About Cambridge, ox-eye daisies were so infested with small insects that ladies objected to having them brought into the house among cut flowers; and flying insects, he thought, did not disdain them.

As to the benefit of cross-fertilization, this was a large subject, which could not be disposed of in a few words; but Dr. Gray thought it probable that cross-breeding even of flowers in the same inflorescence was better than self-fertilization, and that wherever this occurred wider crossing was common.

Mr. MARTINDALE called attention to the fact that, in the case of Staphylea, the stigma is ready for the pollen some time before it can receive it, and suggested that, therefore, perhaps the first flowers do not produce seed.

Dr. GRAY rejoined that it could seldom happen that the first flower of every branch on a shrub or tree, or on different trees of the neighborhood, all opened on the same day; so that even the earliest flower had a fair chance to be fertilized.

Mr. MEEHAN handed a specimen of *Orobus atro-purpureus* from the table, and remarked that it might aid in settling that question; as, so far as his recollection now served him, it was the first flower of the season and of the raceme, and only the first flowers that generally perfected seed.

On Samarskite.—JOSEPH WILLCOX made some additional statements in reference to samarskite, which, until recently, has been a very rare mineral. The first discovery of it in Mitchel County, North Carolina, occurred in the spring of 1873, in a mica mine; and during that and the succeeding year about 700 pounds of the mineral were found, since which time the mine has not been operated.